

Books

Krakatau 1883: The Volcanic Eruption and Its Effects

Tom Simkin and Richard S. Fiske, Smithsonian Institution Press, Washington, D.C., 461 pp., 1983, \$15.

Reviewed by John C. Fiske

During the last couple of years, scientific and general interest in volcanoes has surged as a result of the fiery performance of Mt. St. Helens, and that's why *Krakatau 1883* promises to become a good seller. What does it offer? The writer begins with a detailed chronology of the eruptions, eyewitness accounts, and media coverage that cover local and regional effects, the eruptions and their catastrophic results, and the sonic effects.

Next is a section with translated parts of Verbeek's monumental monograph on the 1883 eruptions, followed by reprints of other scientific papers, and summaries of recent work on the event. For those deficient in French or Dutch, the translation of Verbeek's work will be especially welcome, because this is a major scientific achievement and interpreted a colossal amount of data.

Since volcanic eruptions belong to the small group of geological phenomena in which something happens during a time span accessible to humans, the value of eyewitness accounts should not be underestimated. Many speculations and interpretations could have been made if we could have been there at the time, so the stories of local Dutch citizens are particularly useful. One can ask, of course, how accurate are the descriptions of many of the phenomena? In my own experience, in interviews with locals after a major eruption, people tend to tell that a village was covered by 50 cm of ash while you just measured 3 cm. However, from the wealth of accounts published in the Krakatau book, many prominent features of the eruption are repeatedly mentioned in eyewitness accounts.

Very details of human suffering do not abound in the book. It was written with the living in mind, given the inclusion of papers easily accessible to the scientific community. The writers have succeeded in bringing together many details of the eruption, summarizing its world-wide effects, and at the same time giving us a glimpse into the world of Dutch colonial life at the turn of the century.

For the professional, there is much to gain in the original descriptions of the products and of the changing morphology of the island. Also, we can sense the evolution of scientific thought. It is interesting to observe

how logical some of the old, now-ridiculed ideas sound when set back using their arguments and observations. Verbeek's meticulous descriptions make his data excellent for reinterpretation. Current thinking on the eruption is that the volcano formed by collapse, that the eruptions were not phreatic-magmatic (although many steam blasts were observed and an extremely lapilli and mud are commonly cited in the eyewitness descriptions), and that magma mixing occurred prior to or during the eruption. Interesting details mentioned are the high salt contents on the ash, either condensates of magmatic vapor or resulting from seawater evaporation, and the presence of big chunks of dense obsidian in the ash beds.

In most eyewitness accounts, complaints are voiced on the irritating smell of sulfur vapor, and since the smell of rotten eggs is never mentioned, one may assume that SO₂ was the dominant sulfur-gas species during the eruption. Puzzling features are inclusions of pyrite noted in the felsic phenocrysts (F-rich magma) and low crystal contents of the magma.

Important problems remain: Is the mixed-in basaltic magma component similar in composition to the Andak-Krakatau magma? Is there a parent-daughter relation between the 1883 magma and that basaltic magma? A detailed petrologic study of the products is much needed. The book's reference list covers the geophysics of the Kerguelan-Antarctic Passage are excellent syntheses in the Heezen tradition. A short review of the insightfully imaginative mapping carried out by Jones and Sharp over 25 years is nicely documented by M. Sharp and should be required reading by all students of the sea-floor.

At its price of more than \$100 it can recommend it only to those individuals who can afford to keep a well-stocked library. Bruce Heezen deserves a commemorative volume filled with benchmark papers and I am afraid that this book, to quote R. A. Scruton in the book's preface, is but a "modest memorial to one of the greatest oceanographers of post-World War II years."

Paul J. Fox is with the Graduate School of Oceanography, University of Rhode Island, Kingstown, RI 02881.

The Ocean Floor

Bruce Heezen Commemorative Volume, R. A. Scruton and M. Valcavich (eds.), John Wiley, New York, ix + 318 pp. and pocket maps, 1982, \$16.

Reviewed by Paul J. Fox

Over a relatively short period of time, Bruce Heezen made significant, imaginative and timely contributions to our understanding of the processes that govern the origin and evolution of oceanic crust in space and time. It is certainly fitting that some of Heezen's stature be honored by a memorial volume and the collection of papers in *The Ocean Floor* were gathered together for this purpose. Bruce was a gifted scientist with a wide-ranging appetite for all facets of earth science, and in this respect he would have appreciated the juxtaposition of marine geological topics covered in the book, e.g., continental

margin investigations, sedimentological processes, plate tectonic models). Unfortunately, the book does not have an overall impact that measures up in the main that it contributes. Too many of the papers read as if the authors, after having agreed to contribute to the volume, reached deep into their files to dredge up a neglected manuscript on one subject or another. As a consequence, many of the papers lack zest and fail to stimulate interest beyond their narrowly focused themes.

Of the 18 chapters, however, there are several papers of merit. An investigation of the bimagnetic mixing problem as expressed in a suite of high-latitude North Atlantic canyons, by Rundtman and Glover, presents new data that leads to a more realistic understanding of this important process. The factors governing the evolution of submarine canyons are discussed in two papers that summarize submersible investigations of canyons off the eastern U.S. (Mallof et al.) and submersible and multi-tow-beam studies of canyons off the geomagnetic field lines, called the Chapman-Ferraro or magnetopause current. The magnetospheric system includes large-scale currents that flow in the "tail" "Birkeland" currents that flow along geomagnetic field lines into and away from the two auroral regions, the ring current that flows at high altitudes around the equator of the earth, and a complex system of currents that flows completely within the layers of the ionosphere, the earth's ionized atmosphere. The intensities of these various currents reach millions of amperes and are closely related to solar activity.

A Chapman Conference on Magnetospheric Currents was held at the Tides Inn in Irvington, Va., April 3-8, 1983, for the purpose of bringing together scientists and students interested in electric currents in the earth's and other planetary magnetospheres. The knowledge in this area was reviewed and remaining questions were identified. Over 90 registrants from four continents participated in formal presentations, poster sessions, and informal discussions. Forty-two of the conference papers were submitted, and following a peer review of each paper, 37 were accepted for publication in this volume.

It was very appropriate to have this conference as part of the series named in honor of Sylvestre Chapman, because he contributed so much to our understanding of currents in the earth's ionosphere. This volume includes historical articles describing some of Chapman's work, the contributions that Kristian Birkeland and Hanuš Alfvén made to an understanding of magnetospheric currents, and reflections on the scientific interactions between these three great scientists. These articles are included with the hope that some insight can be gained into the complex scientific and personal processes involved in the development of an understanding of our physical environment. It is hoped that the scientific articles included in this volume achieve the conference goals of consolidating and summarizing the present knowledge of magnetospheric currents and of stimulating new research areas. [From the Preface by T. A. Potemra.]

The Earth Through Time

H. L. Levin, 2nd ed., Saunders College Publishing, New York, viii + 513 pp., 1983.

Reviewed by Stanley A. Meltman

The Earth Through Time successfully fills a gap in the world of introductory level geological textbooks, a gap created by the nature of typical undergraduate students. The introductory course taught at many institutions is physical geology wherein potential geology majors and students who simply want to fulfill part of a natural science requirement form a cosmopolitan class. Students who are convinced that geology is the major for them go on to historical geology in the second semester often using the Dot and Batten text, *Evolution of the Earth*, a text that is rigorous and designed strictly with the geology major in mind. Based on my experience, however, a sizable number of students who have no intention of majoring in geology desire to take a second course in the field out of pure interest and as a means of satisfying the second part of a typical 2-semester science requirement. *The Earth Through Time* provides a viable alternative to Dot and Batten's book, one certainly as broad in its overall coverage but with discrete topics—such as local stratigraphic nomenclature and detailed discussions of geology outside of North America—being deemphasized.

The chapters "Life through Time," "Time and Geology," and "Human Origins" are particularly well written. The illustrations used to explain the concept of absolute geologic time are especially effective. Also, the presentation of a separate section on economic resources at the end of each chapter of geologic time is a useful innovation. The writing style is concise and informative; there are few typographical errors to mar the readability of the text. Students will find this helpful as they study the review questions and the terms-to-remember section listed at the end of each chapter as well as the text's extensive, 22-page glossary.

In my opinion it would be advantageous, in the next edition of this text, to add a 1-page *Periodic Table of the Elements* to the introductory chapter concerning earth materials and to greatly expand Appendix A (Classification of Living Things), making it a capsule review of the paleontologic aspects of historical geology of the sort found in Kummel's *History of the Earth*. Everything considered, I highly recommend Levin's *The Earth Through Time* to all teachers of earth history courses.

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AGU New Books

Magnetospheric Currents, *Geophysical Monograph Series*, vol. 28, edited by T. A. Potemra, x + 337 pp., color and black-and-white illustrations. AGU, Washington, D.C., 1984, ISBN 0-87596-035-0, AGU members, \$23.10; others, \$33.

When viewed from outer space, the earth's magnetic field does not resemble a simple dipole but is severely distorted into a comet-shaped configuration by the continuous flow of solar wind plasma. A complicated system of currents flows within this distorted magnetic field configuration, called the "magnetosphere." For example, the compression of the magnetosphere by the solar wind plasma is never mentioned, one may assume that SO₂ was the dominant sulfur-gas species during the eruption. Puzzling features are inclusions of pyrite noted in the felsic phenocrysts (F-rich magma) and low crystal contents of the magma.

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